SAMSKRUTI COLLEGE OF ENGINEERING & TECHNOLOGY

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Kondapur(V), Ghatkesar(M), Medchal(Dist)

Department of Electrical and Electronics Engineering

Hand Out

Subject Name:Analog Electronics

Prepared by (Faculty Name):
K.DEEPA, Asst.Prof, ECE

Year and Sem, Department: II Year- I Sem, EEE

Unit – I: DIODE CIRCUITS:

Important Points / Definitions:

- Amplifier is an electronic device used to strength the given input signal.
- Classification of amplifiers-based on: Type of frequency, feedback, operation, coupling etc.
- Distortion in amplifiers: Voltage frequency and delay distortions.
- Analysis of CE, CB & CC using hybrid model to calculate values of A_I, R_I, A_V, Y_O. By finding these values the manufacturer can estimate and design proper Amplifier circuits.

CONFIGURATION	VOLTAGE GAIN	INPUT RESISTANCE	OUTPUT RESISTANCE	CURRENT GAIN
CB	MEDIUM	VERY LOW	HIGH	<1 (LESS THAN 1)
CE	MEDIUM	LOW	LOW	HIGH
CC	LOW	HIGH	VERY LOW	HIGH

- Common Base Configuration:-
  - i) Input and output are in phase.
  - ii) Voltage Gain is medium.
  - iii) Current Gain is less than 1.
  - iv) Ri is very low.
  - v) Ro is high.
  - vi) Application: As input stage of multistage amplifiers.
- Common Emitter Configuration:-
  - i) Input and output are 180^0 out of phase.
  - ii) Voltage Gain is medium.
  - iii) Current Gain is high.
  - iv) Ri is low.
  - v) Ro is low.
  - vi) Application: For audio signal amplification.
- Common Collector Configuration:-
  - i) Input and output are in phase.
  - ii) Voltage Gain is low.
  - iii) Current Gain is high.
  - iv) Ri is high.

v) Ro is very low.

vi) Application: For impedance matching.

- Millers Theorem: The Miller theorem refers to the process of creatingequivalent circuits. It asserts that a floating impedance element, supplied by two voltage sources connected in series, may be split into two grounded elements with corresponding impedances.
- Miller theorem helps reduce the complexity in some circuits particularly with feedback by converting them to simpler equivalent circuits.
- Different coupling schemes: Used to connect different amplifier configurations- Direct, RC and Transformer coupling schemes.
- RC Coupling:
  i) Coupling components are Resistor and capacitor.
  ii) Blocks D.C
  iii) Flat at middle frequencies.
  iv) Applications: Used in radio and television receivers.
- Transformer Coupling:
  i) Coupling component is impedance matching transformer.
  ii) Blocks D.C
  iii) Frequency response is not uniform.
  iv) Applications: Used in Public Addressing systems.
- Direct Coupling:
  i) Coupling component is impedance matching transformer.
  ii) Allows D.C
  iii) Flat at middle frequencies.
  iv) Applications: Used in DC Amplification.
- Cascade amplifier- CE-CE or CE-CC etc: Increase bandwidth for high voltage amplifiers.
- Cascode amplifier -CC-CB Increases input impedance and gain.
- Darlington pair-CC-CC: The features are listed below:
  i) The current gain of this transistor is high.
  ii) The input impedance of this circuit is high.
  iii) These are widely available in a single package.

Short Question:

1.What is diode and write the applications? Nov-2017

2.Define the transistor and draw the output characteristics of CE? Nov-2015

3.Write the differences of three transistor configurations? Nov-2016

4.What is load line analysis?

5 What is Bias? What is the need for biasing?

6 How does the input impedance increases due to darlington connection?

7 Mention important characteristics of CE amplifier.

Long Questions

1. Derive the expressions A_I, R_I, A_V, Y_O for a transistor in CB configuration using exact hybrid model**? Oct/Nov-2017**

2. Derive the expressions A_I, R_I, A_V, Y_O for a transistor in CE configuration using exact hybrid model? April**-17**

3. A Common emitter transistor has h_{ie}=1100Ω, h_{fe}=50, $h_{re}=2.5*10^{-4}$, h_{oe}=25µA/V. Calculate A_I?April-16

4. A common collector transistor has h_{ie}=1100Ω, h_{fe}=50, $h_{re}=2.5*10^{-4}$, h_{oe}=25µA/V. Calculate A_I, R_I and A_V. If R_S=1K Ω and R $_L$=10K Ω.

5. Compare different coupling schemes used in multistage amplifiers?
6. Analyze cascading in multistage amplifiers with an example?
7. Analyze cascoding in multistage amplifiers with an example?
8. Discuss Darlington pair and derive its necessary expressions?

Fill in the blanks / choose the Best:

1. **0.95** is the current gain for a common-base configuration where I_E = 4.2 mA and I_C = 4.0 mA.
2. The input resistance of CE amplifier is **low**.
3. The output resistance of CE amplifier is **high**.
5. Application of CE configuration is **amplification**.The input resistance of CC amplifier is **high**.
6. The output resistance of CC amplifier is **low**.
7. Cascading of amplifiers is used **to improve the gain**.
8. Among all the transistor configurations which is having a low current gain, **common-base**.
9. Input and output waveforms of CE configuration is **180^o out of phase**.
10. Among all the transistor configurations which is having a low voltage gain, **emitter-follower**.
11. An audio amplifier amplifies upto **few KHZ**
12. Another name for delay distortion is **Phase Distortion**
13. Coupling capacitors mainly used to **Blocks DC**
14. A current ratio of IC/IE is usually less than one and is called **alpha**
15. Transformer coupling in amplifiers mainly used for **Impedance matching**

Important Points / Definitions:

- Frequency Response: The graph drawn between Gain and Frequency is said to be the frequency response. By frequency response we can estimate the values of Bandwidth.
- Bandwidth=Higher cutoff frequency-Lower cutoff frequency.
- Coupling capacitor is mainly used to blocks DC.
- Bypass capacitor connected across R_E, at mid frequency and high frequency it provides very small capacitive reactance.
- When R_E is bypassed, the bypass capacitor has no effect on voltage gain.
- By using Hybrid π model we can analyse high frequency circuits and able to find following parameters: transconductance, base spread resistance, output conductance and feedback conductance. By finding these values the manufacturer can estimate and design proper Amplifier circuits.

Questions

1. Analyze Hybrid π model of transistor CE?
2. Derive the expression for CE current gain?
3. Derive the expression for CE current gain with R_L?
4. Evaluate voltage gain bandwidth product?
5. Identify the relationship between f_T and f_β?

Fill in the blanks / choose the Best:

1. Formula for transconductance **$g_m=\alpha I_E/V_T$**
2. Formula for input conductance **$g_{b'e}=I_C/V_T\ h_{fe}$**
3. Formula for base spread resistance **$r_{bb'}=hie-(h_{fe}V_T/I_C)$**
4. Formula for feedback conductance **$h_{re}g_{b'e}$**
5. Formula for output conductance **$h_{oe}-h_{fe}g_{b'c}$**

6. Gain Bandwidth Product for voltage is **$f_T R_L/\{[1+2\pi f_T C_c R_L][R_s+r_{bb}^{l}]\}$**.
7. Formula for f_β is **$g_m/ h_{fe} 2\pi (C_e+C_c)$**.
8. Formula for f_T is **$g_m/ 2\pi (C_e+C_c)$**.
9. Relation between f_β and f_T is **$f_T = h_{fe} f_\beta$**.
10. $f_H = f_\beta$ at load resistance = **0**.
11. Coupling capacitor is mainly used to blocks **DC**
12. Bypass capacitor connected across R_E, at mid frequency and high frequency it provides very **small capacitive reactance.**
13. When R_E is bypassed, the bypass capacitor has no effect on **voltage gain**

Unit – II: MOSFET CIRCUITS:

Important Points / Definitions:

- The field effect transistor(*FET*) has, by virtue of its construction and biasing, large input impedance which may be more than 100megaohms. The *FET* is generally much less noisy than the ordinary or bipolar transistor.
- A **Junction field effect transistor** is a three terminal semiconductor device *i.e.* input voltage controls the output characteristics of JFET, in JFET current conduction is by one type of carrier i.e., electrons or holes. For this reason, it is also called a unipolar transistor
- The JFET is always operated with gate-source pn junction reverse biased, therefore the gate current is zero i.e. $I_G = 0A$. Since there is no gate current, $I_D = I_S$.
- The JFET must be operated between V_{GS} and $V_{GS\ (off)}$. For this range of gate-to-source voltages, I_D will vary from a maximum of IDSS to a minimum of almost zero.
- The JFET is not subjected to thermal runaway when the temperature of the device increases.
- The drain current I_D is controlled by changing the channel width
- Differences between BJT and FET:

BJT (Bipolar Junctiopn Transistor)	FET (Field Effect Transistor)
1) Current controlled device	1) Voltage controlled device
2) More noisy	2) Less noisy
3) Switching speed low	3) Switching speed high
4) Cost is low	4) Cost is high

- In the analysis of a JFET circuit, the following important terms are often used :
  1. Shorted-gate drain current (I_{DSS})
  2. Pinch off voltage (V_P)
  3. Gate-source cut off voltage [$V_{GS\ (off)}$]
- **Shorted-gate drain current (I_{DSS}).** It is the drain current with source short-circuited to gate (i.e. $V_{GS} = 0$) and drain voltage (V_{DS}) equal to pinch off voltage. It is sometimes called zero-bias current.
- **Pinch off Voltage (V_P).** It is the minimum drain-source voltage at which the drain current essentially becomes constant.
- **Gate-source cut off voltage $V_{GS\ (off)}$.** It is the gate-source voltage where the channel is completely cut off and the drain current becomes zero.

- The main parameters of a JFET are (i) a.c. drain resistance (ii) transconductance (iii) amplification factor.
- **a.c. drain resistance (r_d)** : It is the ratio of change in drain-source voltage (ΔV_{DS}) to the change in drain current (ΔID) at constant gate-source voltage i.e.

a.c. drain resistance, r_d = Δ—Δ

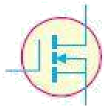
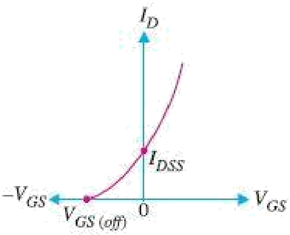
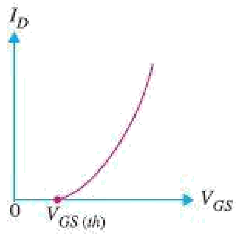
- **Transconductance (g_m)** : It is the ratio of change in drain current (ΔID) to the change in gate-source voltage (ΔV_{GS}) at constant drain-source voltage i.e.

Transconductance, g_m = Δ Δ at constant V_{DS}

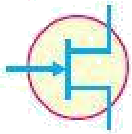
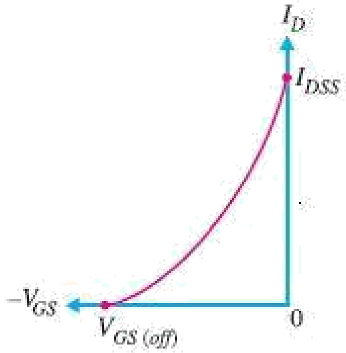
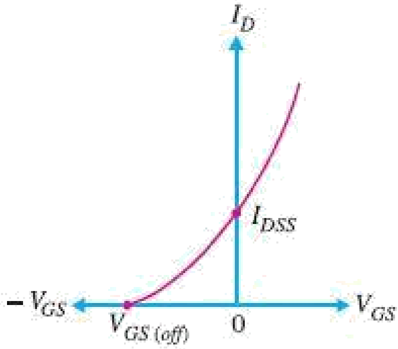
- **Amplification factor (μ).** It is the ratio of change in drain-source voltage (ΔVDS) to thechange in gate-source voltage (ΔVGS) at constant drain current i.e.

Amplification factor, μ = (FET) that can be operated in the enhancement-mode is called a

- A Field Effect Transistor
  MOSFET
- Depletion-type MOSFET or **D-MOSFET.** The D-MOSFET can be operated in both the depletion-mode and the enhancement-mode. For this reason, a D-MOSFET is sometimes called depletion/enhancement MOSFET
- Enhancement-type MOSFET or **E-MOSFET.** The E-MOSFET can be operated only in enhancement-mode
- Differences between Depletion MOSFET and Enhancement Mode MOSFET

Devices:	*D-MOSFETs*	*E-MOSFETs*
Schematic symbol:		
Transconductance curve:		
Modes of operation:	Depletion and enhancement.	Enhancement only.
Commonly used bias circuits:	Gate bias Self bias Voltage-divider bias Zero bias	Gate bias Voltage-divider bias Drain-feedback bias

- Differences between JFET and MOSFET

Devices:	*JFETs*	*D-MOSFETs*
Schematic symbol:		
Transconductance curve:		
Modes of operation:	Depletion only	Depletion and enhancement
Commonly used bias circuits:	Gate bias Self bias Voltage-divider bias	Gate bias Self bias Voltage-divider bias Zero bias
Advantages:	Extremely high input impedance.	Higher input impedance than a comparable *JFET*. Can operate in both modes (depletion and enhancement).
Disadvantages:	Bias instability. Can operate only in the depletion mode.	Bias instability. More sensitive to changes in temperature than the *JFET*.

c) Define Gain bandwidth product. [2]

- Different parameters from Hybrid π model:
  - i) transconductance $g_m=\alpha I_E/V_T$
  - ii) input conductance $g_{b'e}=I_C/V_T\, h_{fe}$
  - iii) spread resistance $r_{bb'}$=hie-($h_{fe}V_T/I_C$)
  - iv) feedback conductance $h_{re}g_{b'e}$
  - v) output conductance $h_{oe}-h_{fe}g_{b'c}$
- The following are the MOS amplifiers- Common source, Common drain and Common gate amplifiers.
- <u>Common Source amplifier:</u> Similar to CE.
  - i) Input Resistance (Ri) = Ri=R_G
  - ii) Output Resistance (Ro) = r_dR_D/ rd+R_D
  - iii) Voltage gain (Av) = -$g_mr_dR_D$/ rd+R_D
- <u>Common Drain amplifier:</u> Similar to CC.
  - i) Input Resistance (Ri) = Ri=R_G

ii) Output Resistance (Ro) = r_d|| R_D|| g_m
iii) Voltage gain (Av) = g_m|| Rs

- Common Gate amplifier: Similar to CB.
  i) Input Resistance (Ri) = Ri= 1/g_m|| Rs
  ii) Output Resistance (Ro) = r_d|| R_D
  iii) Voltage gain (Av) = ($g_m r_d$+1)R_D/ r_d+R_D

SHORT QUESTIONS

a) Write the expression for basic current equation in MOSFET. [2]
b) Compare the AC circuit characteristics of the CS, CG and CD. [3]
c) What are the advantages of push pull amplifiers? [3]

Long Questions

1.Briefly Explain the small signal model of JFET also define Pinch-Off voltage, mutual conductance(g_m), dynamic drain resistance (r_d) and amplification factor (u) for a JFET and establish a relation between them.
2.Draw the circuit diagram, equivalent circuit of a JFET small signal amplifier in CS configuration and derive expressions for A_v, A_i, R_i and R_o.
3.Compare important characteristics of BJT and FET.
4.Explain the principle of MOSFET in depletion mode and enhancement mode with neat sketches and output characteristics.
5.For a NMOS common gate amplifier circuit I_Q=2 mA, R_{si} = 50 kΩ, V_{DD} = 5V, V_{SS} = -5V, R_G = 200 kΩ, R_D = 4.7 kΩ and R_L= 10 kΩ. Calculate the output voltage if input current iv 120 sin ωt μA. MOSFET parameters are V = 1V, K_n= 2 Ma/V^2 and λ = 0.
.
6.a) In a single stage CB – amplifier circuit, RE = 20K, Rc = 10K, VEE = -20V, Vcc = 20V, RL = 10K. Find out Ri , Ro , Ai , Av and power gain in dB.
b) Draw the circuit of two stage R-C coupled transistor amplifier and explain the working of it. [6+4]
7.a).Discuss briefly Cascode amplifier
b).Derive the expression for the CE short circuit current gain Ai as a function of frequency using Hybrid - π model.
8.a) Draw the small-signal high-frequency circuit of a common source amplifier and derive the expression for voltage gain. [4+6] OR
9. a) Why self-bias is not suitable for depletion type and enhancement type MOSFET?
b) In a Drain-to-gate bias circuit VCD = 12V, Rd = 2k,Rf = 10m. Calculate VGS, ID and VDS for ID(ON) = 6mA, VGS(ON) = 8V, VGS(TH)=3V.

Fill in the blanks / choose the Best:

1.A JFET has three terminals, namely **source, gate, drain**

2.A JFET is a **voltage** driven device

3.The gate of a JFET is **reverse** biased

4.When drain voltage equals the pinch-off voltage, then drain current **remains constant** with the increase in drain voltage.

5.If the reverse bias on the gate of a *JFET* is increased, then width of the conducting channel is **decreased**.

6.The two important advantages of a JFET are **high input impedance and square-law Property**

7.The pinch-off voltage in a JFET is analogous to **grid cutoff** voltage in a vacuum tube

8.The input impedance of a MOSFET is of the order of **several M Ω**

9.The gate voltage in a *JFET* at which drain current becomes zero is called **pinch-off** voltage

10. The Transconductance of a JFET ranges from **0.5 to 30 mA/V**

11. An n-channel D-MOSFET with a positive V_{GS} is operating in the **Enhancement-mode**

12. In a common-source JFET amplifier, the output voltage is **180° out of phase with the input**

Unit – III:MULTI STAGE AND POWER AMPLIFIERS

Important Points / Definitions:

- Large signal amplifier:- Which amplifies both voltage and frequency levels.
- Applications:- Mainly used in PA (Public addressing systems).
- Classification:- 1) Class A and 2) Class B etc.
- 1) Class A:-Class A amplifier is a type of power amplifier where the active device (transistor) conducts only for full cycle of the input signal. That means the conduction angle is 360° for a Class A amplifier.
- Types of Class A:- i) Direct Coupled & ii) Transformer Coupled Class A power amplifiers.
  - i) Direct Coupled Class A Power amplifier:
    - a) Easy to design.
    - b) Cost is low.
    - c) Efficiency is: Ideal case 25% and Practical case 15%
  - ii) Transformer Coupled Class A Power amplifier:
    - a) Complicate to design.
    - b) Cost is high.
    - c) Efficiency is: Ideal case 50% and Practical case 30 to 35%
- 2) Class B:-Class B amplifier is a type of power amplifier where the active device (transistor) conducts only for one half cycle of the input signal. That means the conduction angle is 180° for a Class B amplifier.

- Efficiency of Class B:Ideal case 78.5% and Practical case 65 to 70%
- Compared with Class A, Class B is more efficient.
- Types of Class B:- i) Push-Pull & ii) Complementary Symmetry Push-Pull Class B power amplifiers.
- Comparision between Class A and Class B:

Parameter	Class A	Class B
Operating Cycle	360^0	180^0
Efficiency	Low	Better
Distortion	Absent	Present
Power Dissipation	Very high	Low

- Heat sink: Used to dissipate the developed heat in the transistor. It carries the heat to surroundings.
- Tuned Amplifier: An amplifier with tuned circuit is said to be tuned amplifier.
- The tuned circuit is capable of amplifying a signal over a narrow band of frequencies. • Resonant frequency $Fr = 1/2\pi\sqrt{(LC)}$
- Q factor: It is a measure of efficiency with which inductor can store the energy.
- Q factor is inversely proportional to dissipation factor (D).
- 3dB bandwidth is the ratio of resonasnt frequency to effective Q factor.
- Classification of tuned amplifiers:
  i) Single tuned, ii) Double tuned & iii) Stagger tuned amplifiers
- Single tuned amplifier: Effect of cascading in single tuned amplifiers can be explained by the following formula.
- $(B.W)n = BW_1\sqrt{(2^{(1/n)}-1)}$; n $\rightarrow$ no of stages.
- Double tuned amplifier: Two single tuned amplifiers are cascaded.
- Effect of cascading in double tuned amplifiers can be explained by the following formula.
- $(B.W)n = BW_1*(2^{(1/n)}-1)^{1/4}$; n $\rightarrow$ no of stages.
- Differences between Synchronous and Stagger tuned amplifiers.

Synchronous tuned amplifier	Stagger tuned amplifier
1) The overall bandwidth is lower than that of a single tuned circuit alone.	1) The overall bandwidth is greater than that of a single tuned circuit alone.
2) Magnitude is more	2) Magnitude is less
3) Pass band is narrow	3) Pass band is wider

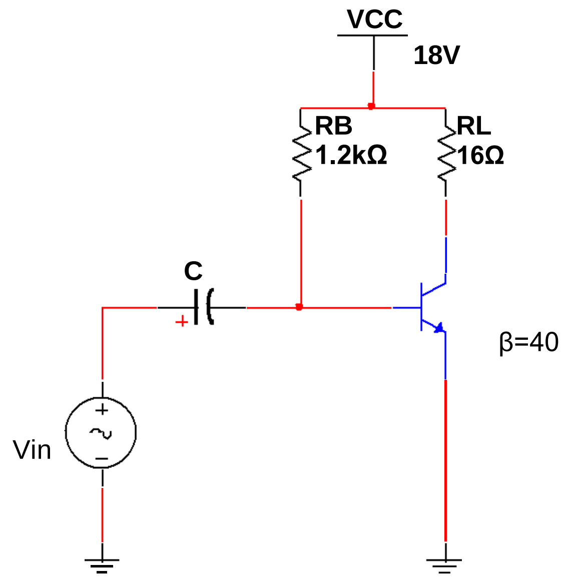
- Stability: Stability of tuned ampliers is improved by the following techniques:
  i) Hazeltine Neutralization.
  ii) Missmatch technique.
  iii) Neutrodyne Neutralization.

Short Questions:

1.Design a single tuned capacitive coupled amplifier?
2.Discuss effect of cascading single tuned amplifiers on band width?
3.Compare synchronous tuning and stagger tuning?
4.Explain Hazeltine neutralization technique?
5.Band width for a single tuned amplifier is 20KHz. Calculate bandwidth of 3 stages is cascaded and also calculate bandwidth of 4 stages?
6.Band width for a double tuned amplifier is 20KHz. Calculate bandwidth of 4 stages is cascaded?

Long Questions

1.Explain series fed class A power amplifier with necessary equations, advantages and disadvantages?
2.Calculate the input power, output power and efficiency of class A power amplifier which is shown below. The input voltage causes a base current of 5mA and assume V_{BE}=0.7V?



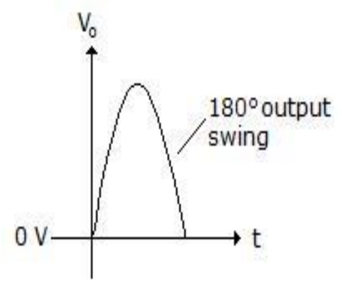
3.Explain Transformer coupled class A power amplifier with necessary equations, advantages and disadvantages?
4.Explain push pull class B power amplifier with necessary equations, advantages and disadvantages?
5.Explain complementary symmetry push pull class B power amplifier with necessary equations and advantages?
6.A single transistor operates as an ideal class B amplifier. If DC current drawn from the supply is 25mA. Calculate AC power delivered to the load for R_L of 2KΩ
7. Explain about Distortion in power amplifiers briefly?
8. For harmonic distortions of D_2=0.1, D_3=0.02 and D_4=0.01 with fundamental component of I1=4A and RL=8Ω. Calculate:
i) Total harmonic distortion.
ii) Fundamental power component.
iii) Total power.

9.Explain and draw the R-C coupled amplifier?

10.Explin the differential amplifier circuit?

Fill in the blanks / choose the Best:

1. In **class A** power amplifiers, the output signal varies for a full 360º of the cycle.**Class D** amplifiers have the highest overall efficiency.
2. **Class A** power amplifiers has the lowest overall efficiency.
3. Class D operation can achieve power efficiency of over **90%**.
4. The fundamental component is typically **larger than** any harmonic component.
5. The **junction** has the hottest temperature in a power transistor.
6. **Both npn and pnp or nMOS and pMOS transistors** can be used to build a class B amplifier.
7. A heat sink provides a **low** thermal resistance between case and air.
8. In tuned amplifiers harmonic distortion is **less**.
9. Generally tuned amplifiers are used in **RF amplifiers and communication receivers**.
10. This is an example of the output swing for a **Class B** amplifier



12. The main features of a large-signal amplifier is **the circuit's power efficiency, maximum power limitations and impedance matching to the output device.**
13. What is the ratio of the secondary voltage to the primary voltage with the turn ratio in the windings **N2/N1**
14. **Class AB** amplifiers are normally operated in a push-pull configuration in order to produce an output that is a replica of the input.
15. Which type of power amplifier is biased for operation at less than 180º of the cycle is **Class C**
16. A tuned amplifier is generally operated in **Class C**operation
17. A tuned amplifier is used in **Radio frequency** applications
18. Frequencies above **200** kHz are called radio frequencies
19. At series or parallel resonance, the circuit power factor is **1**
20. The voltage gain of a tuned amplifier is **Maximum** at resonant frequency
21. At parallel resonance, the line current is **Minimum**.
22. At series resonance, the circuit offers **Minimum** impedance
23. A resonant circuit contains **L and C** elements
24. At series or parallel resonance, the circuit behaves as a **Resistive** load
25. At series resonance, voltage across L is **Equal to but opposite in phase to** voltage across C
26. When either L or C is increased, the resonant frequency of LC circuit **decreases**
27. At parallel resonance, the net reactive component circuit current is **Zero**
28. In parallel resonance, the circuit impedance is **L/CR**
29. In a parallel LC circuit, if the input signal frequency is increased above resonant frequency then **X_L increases and X_C decreases**
30. If L/C ratio of a parallel LC circuit is increased, the Q of the circuit is **increased**

UNIT-IV-FEEDBACK AMPLIFIERS AND OSCILLATORS:

Important Points / Definitions:

- Feedback in amplifiers is mainly used to improve Bandwidth. If bandwidth is improved the operating range of an amplifier will be improved.
- Feedback Classification: Positive feedback and negative feedback.
- Negative feedback: The output is out of phase with input signal.
- Negative feedback amplifiers:

Negative feedback amplifiers	Input resistance	Output resistance
Voltage Series	Increases	Decreases
Voltage Shunt	Decreases	Decreases
Current Series	Increases	Increases
Current Shunt	Decreases	Increases

- Positive feedback: The output is inphase with input signal.
- Example for positive feedback is oscillators.
- Oscillator is an electronic device which satisfies Barkhausen criteria.
- Barkhausen criteria:-
  1) Overall phase shift around the loop is 0º/360º.
  2) Aβ=1.
- Type of oscillators:-
- i) Low frequency oscillators: Which generates frequency less than 20 KHz (f<20KHz): i) RC Phase shift oscillator:
  a) The feed backnetworkprovides 180^0 phaseshift and ampolifier section provides another 180^0
  b) Total phase shift around the loop is360^0
  c) f = 1/(2πRC√6)
- ii) Wein bridge oscillator:
  a) The feed backnetworkprovides 0^0 phaseshift and ampolifier section provides another 0^0
  b) Total phase shift around the loop is0^0
  c) f = 1/(2πRC)

- 2) High frequency oscillators: Which generates frequency greater than 20 KHz (f>20KHz): i) Hartley, ii) Colpitts and iii) Crystal oscillators.

g) List the four basic feedback topologies. [2]

h) State Barkhausen criterion for sustained oscillation. What will happen to the oscillation if the magnitude of the loop gain is greater than unity? [3]

i) Define Harmonic distortion and inter modulation distortion. [2]

SHORT QUESTIONS:

1. Analyze the Negative feedback amplifier and derive A_{vf}?
2. Derive R_i and R_o for a voltage shunt feedback amplifier?
3. Derive R_i and R_o for a voltage series feedback amplifier?
4. Derive R_i and R_o for a current shunt feedback amplifier?
5. Derive R_i and R_o for a current series feedback amplifier?
6. Derive frequency of oscillations for RC phase shift oscillator?
7. An RC phase shift oscillator is designed with a frequency of 5kHz and a resistance of 9.7KΩ is used. Calculate the value of capacitance?

LONG QUESTIONS

1.Derive frequency of oscillations for Wein Bridge oscillator?

2.A Wein Bridge oscillator has a frequency of 500Hz if value of capacitance is 100pF. Calculate value of resistance?

3.Derive frequency of oscillations for Hartley oscillator?

4.a) Explain with the help of mathematical expressions, how the negative feedback in amplifiers increases amplifier bandwidth and reduces distortion in amplifiers.

b) In a transistorized Hartley oscillator the two inductances are 2mH and 20μH while the frequency is to be changed from 950KHZ to 2050KHZ. Calculate the range over which the capacitor is to be varied.

5. An amplifier circuit has a gain of 60 dB and an output impedance Zo=10K by applying negative feedback 500.Ωrequired to modify its output impedance to 500 Calculate the value of the feedback factor. Also find the percentage change in the overall gain, for 10% change in the gain of the internal amplifiers

b) What are the factors that affect the frequency stability of an oscillator? How frequency stability can be improved in oscillator

Fill in the blanks / choose the Best:

1. Parallel resonant frequency is **approximately 1 kHz higher than** series resonant frequency.
2. The formula for input resistance of votage series feedback amplifier is **$R_{if}= R_i (1+\beta A_v)$**.
3. The formula for input resistance of current series feedback amplifier is **$R_{if}= R_i (1+\beta G_M)$**.
4. The formula for output resistance of current shunt feedback amplifier is **$R_{of}= R_o (1+\beta A_i)$**.
5. The formula for output resistance of votage shunt feedback amplifier is **$R_{of}= R_o/(1+\beta R_m)$**.
6. For a wein bridge oscillator frequency required for oscillations is $f= 1/2\pi RC$
7. For a colpitts oscillator frequency required for oscillations is f= **$1/2\pi\sqrt{(LC_{eq})}$ (or) $1/\{2\pi(LC_{eq})^{1/2}\}$**.
8. For an RC oscillator frequency required for oscillations is f= **$1/\{2\pi RC\sqrt{6}\}$**.
9. The feedback signal in a **colpitts** oscillator is derived from a capacitive voltage divider in the LC circuit.
10. Sinusoidal oscillators operate with **positive** feedback.
11. Barkhausen criteria states that overall phase shift around the loop is**0º/360º**
12. The type of amplifier used in RC phase shift oscillator is **Inverting amplifier**
13. The type of amplifier used in Wein bridge oscillator is **Non inverting amplifier**
14. The input resistance of votage shunt feedback amplifier is **decreases**
15. The input resistance of current shunt feedback amplifier is **decreases**